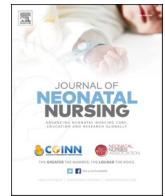




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Parental views of live streaming technology on a tertiary neonatal unit in the UK: A quantitative survey

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ABSTRACT

Introduction: The use of live stream technology has been introduced on neonatal units to improve parent access to their babies. This study aimed to explore parents' experiences of using webcam technology on a neonatal unit. **Method:** This was a prospective, survey-based study. Parents were eligible to participate if they had been offered the use of a webcam while their baby was admitted to the neonatal unit.

Results: 124 parents completed questionnaires. The majority of parents opted to use the webcams (97%). Most parents reported a decrease or no change in anxiety levels (76%). Thematic analysis highlighted perceived advantages to using webcams included reassurance, virtually present when unable to be physically present, bonding, expressing and including extended family.

Conclusion: Webcams enabled babies to be integrated into family, provided an opportunity to enhance parent-infant bonding and improved parent wellbeing. Education and support would help reduce some of the challenges parents experienced.

1. Introduction

Approximately 1 in 7 newborn babies are admitted to a neonatal unit for specialist care in the UK (RCPC, 2019). Survival rates of infants born at lower gestational ages have increased which can lead to prolonged stays in hospitals and greater separation from their parents. This can be extremely stressful for parents who have reported feelings of stress, anxiety, and even post-traumatic stress following their baby being discharged home (Shaw et al., 2013; Malouf et al., 2022). This is likely to have been exacerbated during the COVID-19 pandemic when parents and extended family were restricted from being present with their baby in many neonatal units to reduce potential infection risks (Ciotti et al., 2020; Fonfe et al., 2021).

Innovative technology, such as virtual diaries and live streaming webcams, have been introduced to neonatal units to reduce the separation between parents and their newborn baby and increase parent-infant bonding and attachment. Angel Eye webcams enable parents to see their baby in 'real time' when they are unable to be physically present on the unit. Parents are able to log in through a website on their smartphone or tablet and can share the log in details with extended

family and friends. A systematic review of the literature identified studies that reported positive experiences for parents as well as potential negative impacts upon parental emotional wellbeing (Pajak et al., 2023). Benefits reported include improved parent-infant bonding (Kilcullen et al., 2022), stress reduction (Kubicka et al., 2021), and increased volumes of expressed breast milk when viewing their baby (Reimer et al., 2021). Studies have also reported adverse effects experienced by parents using webcam technology including anxiety at being unable to comfort their baby when they are upset, witnessing a clinical procedure (Reimer et al., 2021), and concerns about increased levels of stress and anxiety for healthcare professionals leading to reduced care (Le Bris et al., 2020).

Despite the growing interest in live streaming technology, there is a still limited knowledge about how parents feel about using live streaming technology, particularly in the UK. Recommendations have been made to conduct further research in this area before webcams can be introduced within the standard of neonatal care (European Foundation for the Care of Newborn Infants, 2018). This study aimed to explore parents' experiences of using webcam technology. This is part of a larger body of research exploring staff perceptions, nursing workload, and

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parental experiences of implementing live streaming webcams in a neonatal unit.

2. Methods

Cot side webcams (AngelEye Health, Nashville TN, USA) were introduced to our tertiary neonatal unit in 2019, as described in reports of the wider research funding (Gallagher et al., 2023; Chant et al., 2023). Webcams were made available to all families whose infant was admitted to our tertiary level neonatal unit as part of a pilot study, with 'viewing' times (i.e. the cameras turned on) between 9 and 11am and 9–11pm.

2.1. Survey development

We created a survey to explore parents' experiences of using the webcams. Questions were developed using a search of the previous literature. The survey comprised 18 questions and included both 5-point Likert scale responses and open-ended questions for parents to provide further information if they wished to. The survey explored the frequency of webcam use, shared access to webcams with extended family, and parent preferences toward webcam use, including benefits and drawbacks. The final question asked parents if they would like to participate further in an interview (results reported separately (Gallagher et al., 2023)). We piloted the survey with a neonatal consultant, clinical nurses and two parents to check whether the questions were easy to understand and to ensure content validity. One question was rephrased to improve clarity.

2.2. Participant recruitment and data collection

All parents who had a baby admitted to the neonatal unit who had been offered the use of webcams, were over the age of 18, and were able to communicate in English were eligible to participate in the study, whether or not they had chosen not to use the webcams. Parents for whom webcam use was restricted due to social concerns were not eligible to take part in the study. Clinical research nurses introduced the study to parents three days after their baby's admission. This enabled them to familiarise themselves with both the neonatal unit and use of the live streaming technology. Written consent was taken at least 24 h following the provision of study information from all parents who wished to take part in the study. Consenting parents were allocated a participant identification number. A paper questionnaire was given to parents with the corresponding study ID. Completed questionnaires were placed in an envelope and handed into reception for the research nurses to collect. Parents were given the option to complete a questionnaire individually, or together as a joint response at their discretion. Parents opting to combine their responses were given one study ID. Parents were invited to participate in the study for a 6-month period between 1st February and 31st August 2021.

2.3. Data analysis

Parent responses were entered into Opinio by the research team. Opinio is hosted by University College London (UCL) Information Services Divisions (ISD) infrastructure and meets NHS ISO security standards. Data were exported into Microsoft Excel for analysis, and descriptive statistics were used to analyse questions using frequency and Likert scale responses. Open-ended responses were uploaded into NVivo to facilitate content analysis, identifying key words and phrases within the data to develop defining key themes. (Graneheim and Lundman, 2004). To optimise the rigour of the content analysis, two researchers (KG and KC) independently immersed themselves in the data to identify key words and phrases to develop key themes. Coding was discussed between the researchers to determine the final results.

2.4. Ethical approval

The study was approved by the West of Scotland Research Ethics Committee (ID: 20/WS/0155), the Research and Development Department of the participating NHS Trust (ref: 134712) and was also registered under the National Institute for Health Research (NIHR) Portfolio.

3. Results

In total 124 parents (94 mothers, 30 fathers) completed the questionnaire survey, representing 94 infants on the neonatal unit (47 male, 47 female). The most common reasons for admission were prematurity ($n = 74$, 79%; mean gestational age 31 + 3 weeks), and congenital anomaly ($n = 12$, 13%). Not all parents answered all questions; percentages have been calculated according to the individual question response rate.

Nearly all parents entering the study (97%, $n = 99$) opted to use the webcams when offered to them. When asked whether parents had shared the login details with family and friends to view their baby, the majority of the 97 respondents had done so (77%, $n = 75$). Grandparents were the most likely extended family members invited to view the live stream. Of the participants responding who had other children ($n = 53$), over half used the webcams to introduce a sibling to their new baby brother/sister (66%, $n = 35$).

The majority of participants responded that the ability to view their baby through live streaming technology was important or very important to them (87%, $n = 88/101$). When asked about webcam security, 76% (75/99) were either confident or very confident that their webcam viewing was secure. A similar proportion (76%, $n = 74/97$) found using the live streaming technology either easy or very easy to use, and 90% of participants ($n = 91/101$) reported feeling comfortable or very comfortable with their baby having a webcam on their cot side.

Nearly all participants (99%, $n = 100/101$) felt that live streaming technology was beneficial for parents whose baby is admitted to a neonatal unit. Parents provided further information about the perceived benefits of webcam use through open-ended responses; frequency analysis of comments identified five themes: (1) reassurance, (2) virtual presence when unable to be physically present, (3) bonding, (4) expressing and (5) including extended family (Table 1).

Parents were asked to report any drawbacks to viewing their baby through the live stream technology; 40% ($n = 38/95$) of parents perceived challenges in using webcams. Parents provided further information exploring the perceived drawbacks of webcam use through open-ended responses. Frequency analysis identified three themes: (1) feeling unable to help their baby, (2) uncertainty around what is happening clinically and (3) general camera concerns (Table 2).

When asked about any webcam related anxiety, just over half of participants reported a decrease in feelings of anxiety (56%, $n = 54/96$), whilst for 24% expressed increased anxiety ($n = 19/96$). The remaining 20% reported no change. Parents were asked to provide further information exploring their experiences of increased or decreased stress as a result of using the webcams through open-ended responses; frequency analysis of comments identified three themes: (1) reassurance of baby's wellbeing, (2) negative impacts on emotional health and (3) positive impacts on emotional health (Table 3).

When asked how frequently participants would like the video streaming to be live throughout the day, just under half of participants wished for constant live streaming (47%, $n = 45/96$), a further 43% ($n = 41/96$) suggested between 2 and 5 hrs per day, and 10% felt that 1–2 hrs as offered was sufficient.

4. Discussion

This study aimed to explore parent experiences of using live streaming webcams while their baby was admitted for neonatal care. Our results highlight that parents found the webcams to be beneficial to

Table 1

Themes representing parental perceptions of the benefits of webcam use on the neonatal unit.

Theme	Frequency count of responses (n)	Illustrative quotes from participant responses
Reassurance	35	'Being separated from my baby literally defies every instinct in my body. Being able to see her from home instantly calms me when I'm anxious' 'Reassurance that our daughter is resting comfortably and is being taken care of while we aren't able to be with her'
Virtual presence when unable to be physically present	35	'Due to locations between homes and hospital sometimes it is difficult to attend all the time' 'Always good to be able to see our babies especially when we cannot come to the hospital early and we are looking after another child'
Bonding	21	'Bonding, learning your baby's cues and behaviour' 'Sometimes we would have it on in the evening and 'have dinner with her' next to us. It felt like she was at home when she couldn't be'
Expressing	13	'When parents are expressing breast milk it helps to see your baby' 'Especially to help expressing breast milk'
Including extended family	9	'Being able to show him to his sister' 'Relieves parents from updating other family members as they can view baby themselves'

Table 2

Themes representing parental perceptions of the challenges of webcam use on the neonatal unit.

Theme	Frequency count of responses (n)	Illustrative quotes from participant responses
Feeling unable to help their baby	19	'Anxiety of seeing baby sad and being unable to do anything' 'Anxiety – for example when baby is crying and you know the nurse may be busy with another baby but you are unable to see that'
Uncertainty around what is happening clinically	17	'When webcam is offline without explanation, it is not clear whether it was simply forgotten or whether the baby is unwell/having a procedure/nappy change' 'If it's not turned on in the allocated time, I assumed there was something wrong'
General camera concerns	6	'The service (webcams) could be taken for granted and act as a replacement for essential in person visiting for baby' 'Security – it's a child and as a parent am making choice to view on camera – is it right?'

them and their families, through reassurance and increased opportunities for bonding when parents were unable to be physically present on the neonatal unit. This suggests webcams can help families strengthen bonds and emotional attachment, our findings are similar to those of other studies (Weber et al., 2021; Kerr et al., 2017). Parents reported introducing their baby to siblings, grandparents, and wider family and friend groups. Parents were unable to bring visitors to the unit during the pandemic (although parents had 24 hour access), but enjoyed the

Table 3

Themes representing parental perceptions of any webcam related anxiety.

Theme	Frequency count of responses (n)	Illustrative quotes from participant responses
Reassurance of baby's wellbeing	34	'We can see that he is in safe hands' 'Can see him dressed/happy/fed/sleeping, reassured he is in the best care and we say goodnight to him'
Negative impact on emotional health	29	'More anxious when I see her unsettled or upset' 'If the webcam was not switched on when it was supposed to I assumed something was wrong so would have to ring the nursery and check'
Positive impact on emotional health	6	'Sometimes I miss her as soon as I reach home, I watched her on the live stream and I feel better' 'It quite honestly makes you feel slightly less guilt about not being there 24/7'

feeling the webcam provided that their baby was at home even when they were not. Being able to share 'real-time' images of the baby with extended family appeared to enhance a sense of shared experience that promotes a social support network often missed by parents when their baby is admitted to a neonatal unit.

Parents often experience higher levels of stress and anxiety while their baby is receiving neonatal care. Parents in our study mostly reported lowered or no discernible change in anxiety levels, reinforcing previous research results (Kubicka et al., 2021). However almost a quarter of parents perceived increased levels of anxiety whilst using the webcams and may benefit from additional support. Several parents struggled to interpret what they were observing on the screen. Providing information surrounding what is the expected behaviour of a baby, for example baby movements, sneezing, hiccups, may be beneficial in managing parents' expectations and supporting them in managing the expectations of anyone they share webcam access with.

Technological challenges also raised parent concerns when there were difficulties accessing the system or when the camera was switched off. Parents reported uncertainty regarding the wellbeing of their baby, although often recognised reasons for this, such as the baby receiving routine cares (including nappy changing, re-positioning) or that the nurses might be busy; despite this, many said they would telephone the nursery to confirm. This has been similarly reported by nurses receiving webcam related phone calls from parents (Chant et al., 2023; Joshi et al., 2016). Increased nursing workload and interruptions to nursing workflow are known to increase the risk of errors in care (Tubbs-Cooley et al., 2019). Working closely with parents could potentially mitigate against this through individualised preparation and engagement around the use of webcams in their baby's care. Previous studies have also reported that parents enjoyed seeing their baby having routine care via the webcam, enhancing their inclusion and engagement in their babies care (Gallagher et al., 2023; Kilcullen et al., 2022). Nearly half of parents would have preferred continual live streaming in this study, this might have reduced some of the anxiety experienced by parents when unable to access the live stream. An alternative strategy to minimise parent distress and keep webcam related workload for nurses low would be to consider continuous live streaming to reduce the potential for webcams to be switched on and off around routine care.

This study has several limitations. Whilst designed prior to the COVID-19 pandemic, it was conducted during periods of national lockdown when visiting restrictions for extended family were in place, which may have influenced parents' perceptions of the value of the webcams. Our results are, nevertheless, consistent with previous studies so we anticipate the emotional impact parents experienced at the time does not prevent the results being generalised. We also had a larger number of mothers participate in the study than fathers, so our results

might underestimate father's perceptions and use of webcams. During the study webcam viewing times were also restricted to 2 hrs, twice a day, which may have also influenced our results. Our study is, however, one of few to explore the impact of live streaming webcams on parent experience in the UK.

5. Conclusion

Live streaming webcams can reduce the separation imposed on parents when their baby is admitted for neonatal care. Parents' experience of using live streaming webcams in this study was mostly positive. Benefits for parents centred around reassurance of their baby's well-being, increased bonding, and access to enable family integration, which overall improved parental emotional wellbeing. Webcam related challenges encountered by a subset of parents may be resolved by further parent education and support.

Author contributions

KG, KC JM and NM conceived the idea and obtained funding. KC wrote the first draft and produced the final version. KC, LH and RHW collected data. Each has reviewed and contributed to this paper.

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Declaration of competing interest

None disclosed.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jnn.2024.03.004>.

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